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SPECIAL REPORT - SOVIET SPACE VEHICLES

An analysis prepared by and for the U. S. Government indicates that the Soviet Union has been developing and testing a mammoth, multipurpose launch vehicle for space missions and for intercontinental missiles. The launch vehicle (see following page) appears to be totally unlike anything being developed by the United States.

The analysis was issued by the Air Information Division of the Library of Congress "solely for the exchange and stimulation of ideas" among Government personnel. The document, of close to 200 pages, is based on painstaking study of more than 200 articles, official Russian reports, sketches and books published in connection with the Soviet Space Program between 1958 and 1961. The conclusions "if correct, may be of considerable significance," the U. S. report states.

Some highlights:

* Multipurpose System: "There are indications," the analysis states, "that the Soviets have developed a multipurpose, re-usable winged carrier-rocket as a vertical launch vehicle for spacecraft. The first stage of this vehicle may consist of two piloted 'rocketplanes' of a universal type capable of operating as turbojets, ramjets or rockets." Rocketplane, in this context, is a translation of the Russian term "raketoplan" -- a term evidently denoting a winged aerospace vehicle which, however, is not necessarily rocket-powered.

*Staging: The unique recoverable first stage is said to consist of two such manned winged vehicles, each equipped with four or six air-breathing engines. These engines are said to be capable of operating as turbojets during launch and initial acceleration and as ramjets at higher speeds. A reverse-thrust device for deceleration is also said to be included. The second stage, believed to be non-recoverable, is a highly rigid structure which may contain a variety of fuels for this and other stages. The third stage, according to the U. S. document, may be of any of several different configurations depending upon mission -- warhead, space vehicle or manned satellite.

* Applications: The analysis indicates that this launch vehicle can be used for long range missiles, for putting a payload on the moon, or the planets. There is said to be a possibility that the vehicle was used for the launching of Sputnik VII of February 4, 1961 and the Venus Probe of February 12, 1961. The report, completed prior to recent Soviet manned orbital flights, speculates that this vehicle "might also provide the basis for a recoverable lunar vehicle or for a two-man earth satellite in 1961." According to the author, the Soviet ballistic rocket tests held in the Pacific Ocean area in early 1960 (and recently followed by another test series) were part of the work being conducted on the multipurpose vehicle.

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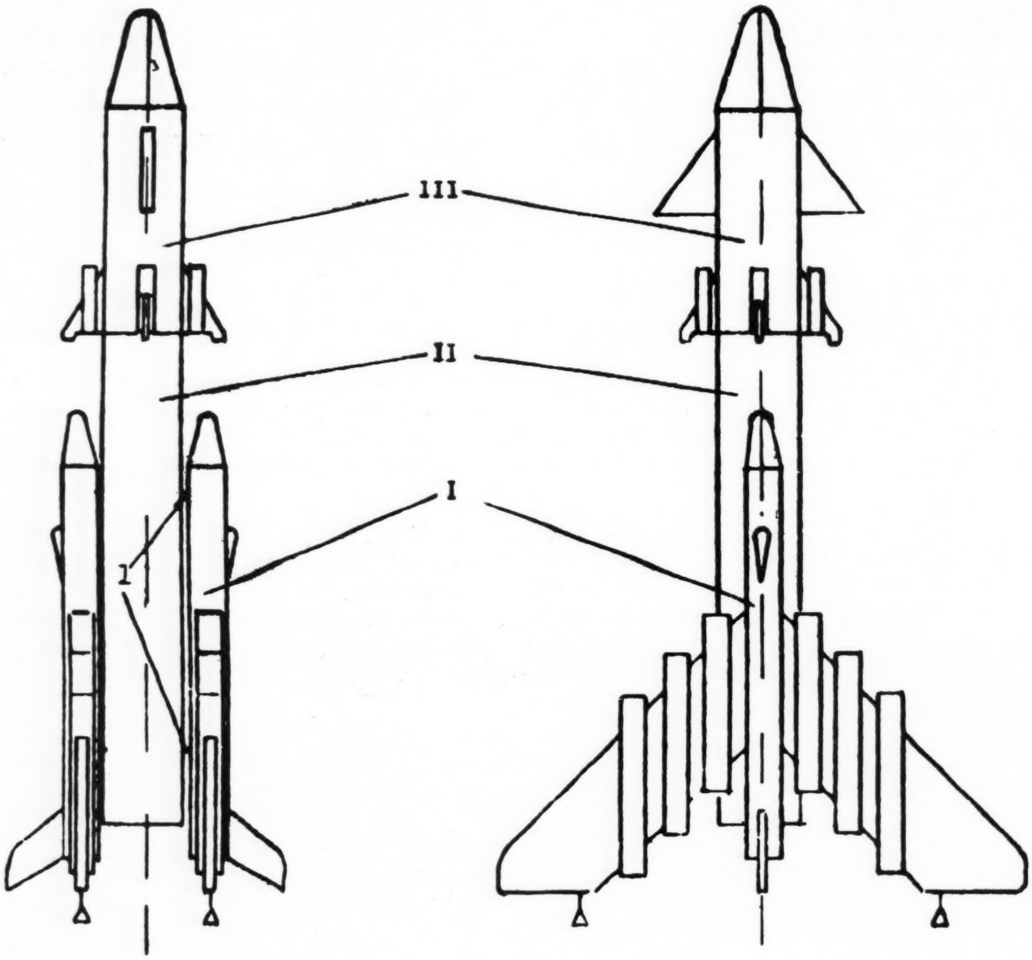
POSSIBLE STRUCTURE OF THE SOVIET MULTIPURPOSE LAUNCH VEHICLE



(This "General view of possible structure of multipurpose carrier-rocket tested by the Soviets on January 20 and 31, 1960" is reproduced by WASHINGTON SCIENCE TRENDS from an analysis of Soviet space programs prepared by the Air Information Division, U.S. Library of Congress. Explanation from the same source.)

Explanation:

I - First Stage. (Two manned "Rocketplanes" equipped with air-breathing engines.)

II - Second Stage. (Nonrecoverable)

III - Third Stage. (Which can be either an intercontinental missile, a recoverable earth satellite or a space vehicle, depending on the purpose of the flight.)

1 - "Points of Connection."

* EFFECTS OF HIGH YIELD NUCLEAR DETONATIONS

Due to the worldwide interest in recent Soviet and U. S. nuclear testing activities, WASHINGTON SCIENCE TRENDS this week presents the full text of the latest appraisals compiled by the Atomic Energy Commission, with the assistance of the Department of Defense. These agencies emphasize that their estimates are subject to many uncertainties. "It is impossible," they state, "to predict with any assurance of accuracy the effects of an actual test detonation of very high yield; this is particularly true if the weapon were to be detonated at a high altitude."

ø Blast Effects -- The blast wave of a 5 megaton surface detonation would be capable of causing severe damage to residential-type structures up to a distance of about 6 miles from ground zero (8 miles for a 10 megaton surface burst, 10 miles for a 20 megaton surface burst, 12 miles for a 30 megaton surface burst, 14 miles for a 50 megaton surface burst and 17 miles for a 100 megaton surface burst). A 5 megaton surface detonation would cause severe blast damage to reinforced concrete structures out to about 4 miles (5 miles for a 10 megaton, 6 miles for a 20 megaton, 7 miles for a 30 megaton, 8 miles for a 50 megaton and 10 miles for a 100 megaton). For an optimum air burst for air blast effects these ranges of blast damage could be increased by 30 to 40 percent.

A 5 megaton detonation above about 35 miles (44 miles for a 10 megaton, 50 miles for a 20 megaton, 60 miles for a 30 megaton, 75 miles for a 50 megaton, 100 miles for a 100 megaton) would cause insignificant blast damage on ground structures.

ø Thermal Effects -- A 5 megaton surface detonation or an air burst below 50,000 feet on a clear day could cause first degree burns to exposed skin out to a slant range of about 25 miles (35 miles for a 10 megaton, 45 miles for a 20 megaton, 55 miles for a 30 megaton, 70 miles for a 50 megaton, and 100 miles for a 100 megaton) and second degree burns to exposed skin out to about 17 miles (25 miles for a 10 megaton, 32 miles for a 20 megaton, 40 miles for a 30 megaton, 50 miles for a 50 megaton and 70 miles for a 100 megaton). Paper and various similar materials would ignite at distances of about 20 miles (30 miles for a 10 megaton, 39 miles for a 20 megaton, 47 miles for a 30 megaton, 60 miles for a 50 megaton and 85 miles for a 100 megaton). Above about 50 miles the thermal effects on the earth's surface of a 20 megaton detonation would be negligible (60 miles for a 30 megaton, 75 miles for a 50 megaton and 110 miles for a 100 megaton). These distances would apply only on clear days and would be materially lessened when the thermal radiation is attenuated, such as on cloudy or hazy days.

ø Initial Radiation -- The initial gamma and neutron radiation expected from a nuclear explosion in the range of 5 to 100 megatons at or near the surface of the earth is not expected to be of significance when compared to the radius of damage from other effects such as blast damage or thermal radiation effects.

ø Electromagnetic Effects on World Communications -- Communication blackouts due to low altitude, high yield explosions are probably too localized to be of interest. If the cloud stablizes at an altitude of about 25 miles, however, the possibility exists of producing observable effects on radio waves over distances of about 100 miles from air zero.

As a result of a 50 megaton detonation at an altitude of about 50 miles, large scale high frequency communications blackouts could be expected within a region of 2,500 miles radius and for a time span of the order of a day. At 30 miles altitude the radius of effect would be about 1,000 miles.

For detonations at the same altitudes as above but with yields less than 50 megatons, the results would be similar but the radius of effect as well as the duration of blackouts would be less. Conversely, a 100 megaton detonation at the same altitudes as discussed for the 50 megaton burst would have a larger effects radius and a longer duration of communications blackout.

It is important to note that in order for a radio wave to be affected, the wave must pass through the disturbed region. Detonations in the Soviet Union of these yields at high altitudes would probably affect some North America to Europe communications. By increasing the altitude of detonation beyond 50 miles the radius of effects would be increased, but the duration of such communications blackouts should decrease. For a detonation of high yield at an altitude of 600 miles, the radius of the communications blackout effect may extend to 4,000 miles.

ø Local Fallout -- For a 20 megaton surface burst, for example, assuming 50% fission yield and 40 knot winds, local fallout of 450 roentgens would be expected at 360 miles downwind (higher exposures at lesser distances) for persons fully exposed for 96 hours following the start of fallout at that place. (450 roentgens would be expected at 415 miles downwind for a 30 MT detonation, at 500 miles downwind for a 50 MT detonation, and at 620 miles downwind for a 100 MT detonation.) It is expected that exposure to 450 roentgens would result in 50% deaths.

For detonations at altitudes such that the fireball does not approach near the ground there would be very little local fallout. The fireball for a 20 MT nuclear explosion would be about 3-½ miles in diameter. (About 4 miles for 30 MT, about 5 miles for 50 MT, and about 7 miles for 100 MT.)

ø World-Wide Fallout -- Assuming that, (a) these detonations took place in the atmosphere so that the fireball does not approach the ground and, (b) the fission yield was 50% of the total yield, then a twenty or thirty megaton detonation would produce less fission products than the current USSR tests to date, (excluding, of course, the detonation of October 23 which is estimated to have been about 30 megatons), and the 100 megaton detonation might produce more than twice this amount.

The debris spread world-wide (as distinguished from local) from all past nuclear tests of all nations prior to resumption by Soviets of atmospheric tests on September 1, 1961, is estimated to have been the equivalent of 60 megatons of fission yield. Thus, for example, a 100 megaton detonation (50 megatons of fission) might produce almost as much world-wide radioactivity as all past tests to November 3, 1958.

The distribution of fallout from such high yield detonations is not known with certainty. However it is estimated that if they were fired in the lower atmosphere, then at most three fourths of the world-wide fallout might occur in the 30°-60° northern latitude zone. If the detonation took place at higher altitudes (greater than 20 miles) the amount of world-wide fallout of long lived radionuclides would be more equally partitioned between the northern and southern hemispheres.

A 5 MT detonation in the lower atmosphere fired north of 30 degrees North latitude might deposit about 4 millicuries of strontium-90 per square mile in the United States, and the one hundred megaton shot might scale up to about 75 millicuries of strontium-90 per square mile. There were about 70 millicuries of strontium-90 per square mile deposited in the United States before the current USSR tests.

* NUCLEAR DETONATIONS (Continued)

It is estimated that increasing the current level of strontium-90 in the United States by many fold would still result in less strontium-90 in the bones than permitted by radiation exposure guides now in effect for the general public for normal peacetime operations.

ø Water Waves -- Water waves produced by high yield nuclear detonations could be of appreciable magnitude hundreds of miles from a deep underwater burst. A 50 megaton burst at a depth of 2,700 feet in deep water would generate wave heights from 20 to 50 feet at a range of 100 miles and 5 to 12 feet at 400 miles. A 100 megaton burst at about 4,000 feet in deep water would generate wave heights of about 28 to 70 feet at a range of 100 miles and 3 to 7 foot waves at 1,000 miles. For lesser burst depths the waves would be of lesser magnitude.

In all cases bottom profiles, in shallow water, and shoreline characteristics could greatly affect wave heights. The increase in the water level at the shoreline from a deep underwater high yield burst could be higher than that of the deep water waves at the same distance from the detonation.

An explosion of 50 MT at surface of ocean would produce waves of a height of about 1 to 10 feet at 100 miles and 3 inches to 2-½ feet at 400 miles. For an above surface explosion at 10,000 feet altitude it is predicted that the waves produced would be less than 1/2 of the surface case. For higher altitudes the waves produced would not be of significant height. All of the above figures are based on a depth of water in the area of generation of about 16,000 feet, for shallower depths the wave heights would be less. In general it is expected that the wave heights would vary as the square root of the yield.

ø Retinal Burns -- If a person were looking at the point of burst from any of these detonations, then burns to a portion of his retina causing some visual loss might be received at ground distances up to 500 miles away on a clear day with no cloud cover for a burst occurring at a 30 miles altitude. A burst at 60 miles altitude might produce the same result at 700 miles. As the altitude of burst increases the severity of retinal damage decreases. However, the severity of retinal damage increases at night.

For a 50 megaton burst in the lower atmosphere on a clear day, for example, retinal burns may be possible out to 250 miles (out to 210 miles for a 20 megaton burst, out to 290 miles for a 100 megaton burst.)

ø Other Effects -- From any of these detonations at high altitude (30 miles to 1,000 miles) widespread and spectacular aurorae could be visible at distances from ground zero to 1,000 miles and, for the larger yields, perhaps out to 2,000 miles for the higher altitudes bursts. These aurorae would not be harmful to human beings. The air glow in the ionosphere produced by the shock wave may also be visible for more than 1,000 miles.

For bursts in deep space, 50,000 miles or more, there would be one sharp pulse of light that might be noticeable only to a person looking directly at the burst. On the basis of current knowledge, it is not expected that there would be any other observable effects to the unaided eye at the earth's surface.

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* AFTER THE SHELTERS, WHAT?

"The effects of nuclear war on man and his environment is awesome to contemplate. Thermal and blast effects, and concomitant radiation, would create vast areas that would be useless to the survival of man. And also, fire, insect devastation and disease. Fallout shelters in many areas seem only a means of delaying death and represent only a part of a survival plan....The question is where does man go after his sojourn in shelters. What does he do upon emergence?"

---John N. Wolfe, U. S. AEC, to the First Symposium on Radio-Ecology.

PUBLICATION CHECKLIST

- ☐ LUNAR PROBES AND LANDINGS, a report by Lockheed Aircraft Corp. for the Air Force, with annotated references to published material (classified and non-classified). Covers lunar probes, lunar landings, design configurations, etc. from January 1959 to May 1961. 40 Pages. (Report AD 259 325 available through military channels or at $4.60 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- ☐ CAREERS IN ENGINEERING, an excellent guidance publication, with material on careers in engineering in general, and the educational facilities at one leading institution in particular. 78 Pages. Single Copies Free. (Write Dean W. L. Everitt, College of Engineering, University of Illinois, Urbana, Ill.)

- ☐ HIGH STRENGTH STAINLESS STEELS, a brief review of some recent developments in these steels and their alloys. 3 Pages. Single copies free to Government agencies, their contractors, subcontractors and suppliers. (Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio for DMIC Memorandum 131)

- ☐ U. S. NUCLEAR REACTORS, a compilation of material on reactors built, being built or planned in the U. S. as of June 30, 1961. 27 Pages. Single Copies Free. (Write Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tenn. for Publication TID 8200 4th Rev.)

- ☐ ADHESIVES IN BUILDING, the proceedings of a 1960 conference on adhesives, lamination, bonding, etc. for building purposes. 105 Pages. $5. (Write Publications Office, Building Research Institute, National Academy of Sciences, Washington 25, D. C. for Publication No. 830)

- ☐ AERONAUTICAL RESEARCH, a transcript of statements, testimony and exhibits presented to Congress during August, 1961 hearings on contemporary and future aeronautical research. 119 Pages. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. regarding Hearing No. 18 - Aeronautical Research)

- ☐ FLAMMABLE MATERIALS, the highlights of a 4-hour lecture and demonstration on the fire and explosion hazards of flammable liquids and solids, oxidizing materials, corrosive liquids and compressed gases, etc. 17 Pages. Single Copies Free. (Write Publication-Distribution Office, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Information Circular No. 8005)

- ☐ RELIABILITY LITERATURE, an Air Force bibliography designed to provide scientists, teachers and students with a ready reference to literature on reliability. Covers military and civilian applications, economic aspects, analysis, etc. 60 Pages. (Report AD 255 988 available through military channels or at $6.60 in photocopy from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- ☐ SCIENTIFIC RESEARCH IN BRITISH UNIVERSITIES, an official outline covering the natural sciences, engineering, medical and other studies. Includes the names of research workers, the scope of work and full indexes. 526 Pages. $5.85. (Write British Information Services, 45 Rockefeller Plaza, New York 20, N. Y.)

- ☐ ASSAY OF RADIOACTIVE SAMPLES, a "handy guide" to some of the problems and techniques in the field of particle counting methods for the assay of radioactive samples. Discusses beta, alpha and gamma counting, and provides general references on the measurement of radioactivity. 71 Pages. (Report ANL 6361 available through AEC channels or at $1.75 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- ☐ WOMEN IN SCIENTIFIC CAREERS, a rather pessimistic view of the present and future prospects for encouraging women to train for and enter careers in science. 18 Pages. 20 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Publication NSF 61-50)